Arduino-based Smart Attic Fan System

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Abstract

Research indicates that on a hot summer day with outdoor temperatures around 80◦F, the temperature measured inside an attic could be around 135◦F or more. Extreme heat causes a homeowner's electric bill for cooling to rise and the shingles of the house to crack and fall off. Such problems make houses unsafe to live in. Due to the cracked shingles, water leaks through the rooftop causing damages like mildew and mold. In this poster, we designed and implemented an Arduino-based smart attic fan system. It uses temperature and humidity sensors to monitor the status inside the attic. If the temperature inside the attic goes too high, or excessive moisture is detected inside the attic, the Arduino controller is going to automatically turn on the attic fan. The built-in camera can take videos inside attic and use wireless communication to upload it to cloud server. The homeowner can use their smart phones to "see" the status inside the attic remotely without the need to actually climb up into the attic. In case there is a fire, the smoke detector could also sense the situation and send out alarm to homeowner's smart phone. This can help homeowners to detect rain leakage or other hazardous situation inside the attic and take actions on time to prevent further damage to the house. Our smart attic fan system utilizes Internet-of-Things (IoT) technology to extend the life of every roof, to lessen roof repair cost, and possibly make attics habitable.

Keywords: Internet-of-Things (IoT), Arduino, Smart Attic Fan, Roof Ventilation.

Introduction

The Internet of Things (IoT) is the relationship between technology and our everyday objects. Its use is to take out the physical strain of our day to day life and introduce a virtual world to facilitate us by connecting to the internet. Computer imbedded objects are called smart. As we are now approaching a time where the use of IoT devices is found in almost everything; imagine the next cure to a disease being only possible due to the use of internet of things. Or a diabetic patient not having to worry about when is the next time to take a shot of insulin because of a smart pump. Through IoT implementations, smart farms are now created to measure and control how much water is needed. The temperature, humidity and soil signals are collected in the agriculture process, and are relayed wirelessly through a M2M (machine to machine) system.

In this paper, we are focusing on using internet of things in order to upgrade a smart house. We designed and implemented an Arduino-based smart attic fan system that uses temperature and humidity sensors to monitor the status inside and outside of the attic. Proper attic insulation is essential for a homeowner's house in order to extend their roof life. When a roof suffers too much heat damage, its shingles crack and fall, which then makes the house vulnerable to mold and mildew when it rains. In addition, houses, with damaged roofs, stationed in places prone to storms and hurricanes can create life threatening situations such as fire. Statistics has shown that roofing repair has been gradually increasing every year, and because most homeowners lack awareness on the status of their roofs; their pockets eventually become the only victims. With the use of our smart phones we are implementing an app that will enable us to control our fan without the need to go to the attic and check the temperature ourselves. By comparing both the exterior and interior temperatures, with the help of temperature and humidity sensors, our app will let us know when it is safe to turn the fan on and off.

Working Principle/Calculation

Attic size: to determine the size of your attic, multiply the width by the length of the attic floor

Example: (30ft width by 60ft long attic)= 30ft * 60ft= 1800 square ft. attic space

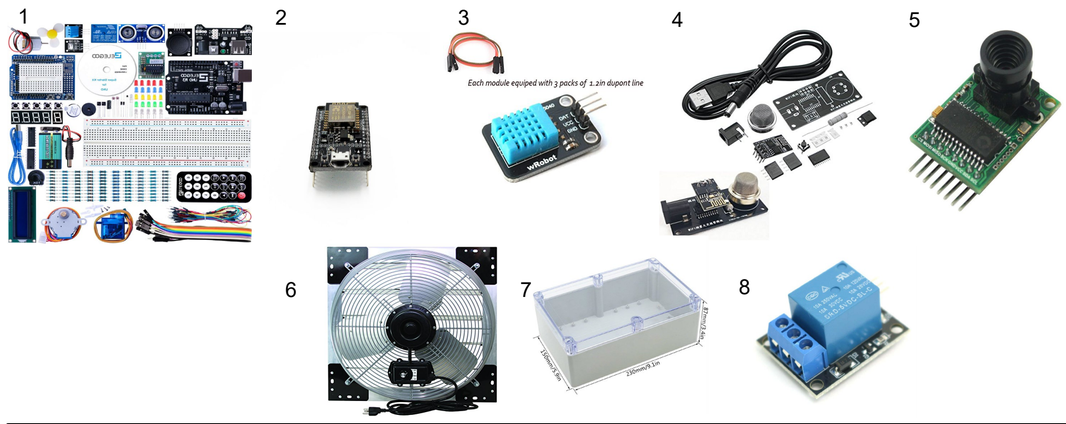
Intake Air Vents

To find out if you have enough vent space, divide the cubic feet of air per minute that the fan is rated for by 300, then we can know how big of intake air vents that we need.

Example: 1260 CFM ÷ 300 = 4.2 sq. ft. intake vent area

Block Diagram and Flow Chart

Hardware Implementation



1. Arduino Microcontroller kit
2. ESP8266 wireless module
3. Sensors (5 pieces)
4. Wi-Fi Smoke alarm
5. Arduino mini camera
6. Fan with Shutter and Cord
7. Waterproof case
8. Relay

Simulation Results

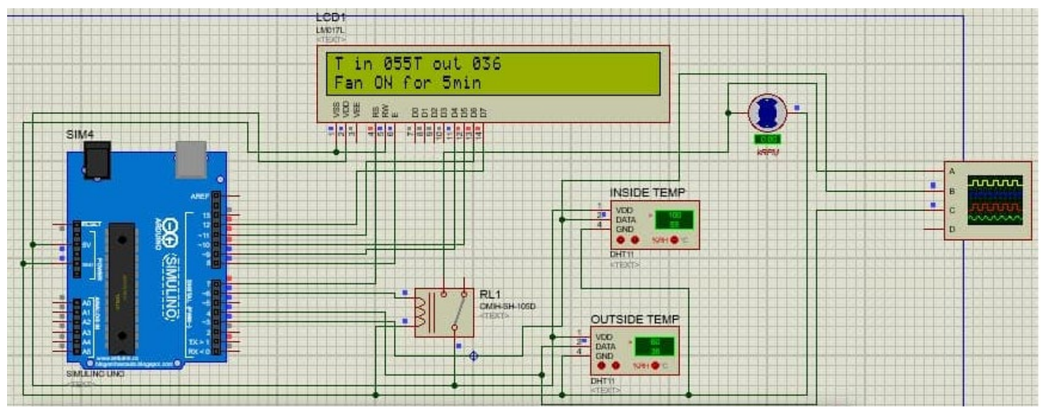


Figure 1.a. Schematic of attic fan and temperature sensors connected to Arduino Uno

Figure 1.b. Waveform

Results and Discussion

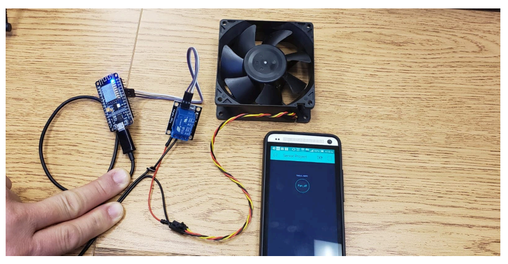


Figure.2.a.Connection of mini Fan to the Blynk app

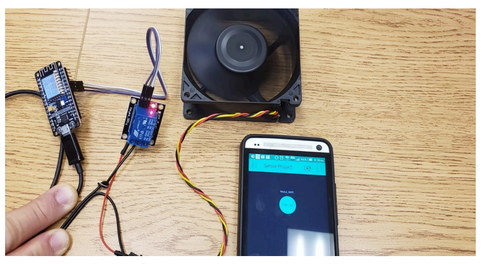


Figure 2.b Operating mini Fan to Blynk

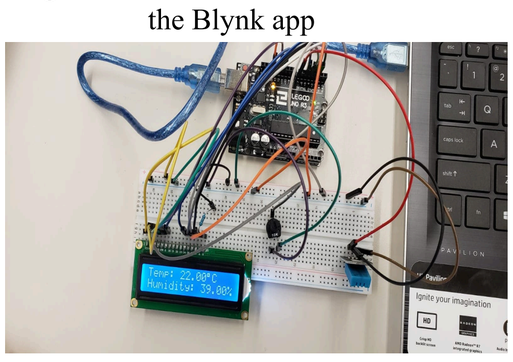


Figure 2.c Display temperature and humidity on LCD

Figure 2.d. Prototype

Conclusions and Future Work

In this project we designed and implemented an Arduino-based smart attic fan for improved attic ventilation. It can sense the temperature and humidity in attics, and automatically turn on and off the attic fan as needed. It can save heating/cooling cost for homeowners, and extend the lifetime of a house. The proposed smart attic fan can also monitor the condition inside the attic with video surveillance camera and send it to the homeowner's smartphone, so that the homeowner can detect any potential hazardous conditions without physically entering the attic. The smart attic fan is implemented and tested to verify the expected functions. In the future, we will continue to add more safety features to the system, and use solar energy to power the attic fan save heating/cooling cost of a house, more powerful sensors and microcontrollers that would have larger ranges to provide more reliable data. Further implementation would be using our Arduino system to work in harmony with the house's heating system so that the user can control the temperature of the house through the Arduino app on their phone.